

Appendices

Appendix 1

Northern Regional Cardiology Follow-up Guidelines

Version: May 2023 Review Due: May 2024

- These are follow-up guidelines only. Individual patient requirements may differ
- Always consider virtual follow-up
- Registrars should discuss follow up arrangements with their supervising SMO
- Letters to GP must clearly state follow up arrangements
- In general patients with hypertension or dyslipidaemia should be followed long term in primary care once condition stable/treated adequately
- Valves – clinical and echo follow up. If frail and comorbid (where valve intervention inappropriate) consider returning care to GP
- Rheumatic valve disease patients - refer to rheumatic fever nurse specialists if available, or ensure appropriate secondary prevention and follow-up as per valve lesions

Valves - follow-up frequency

Pre-Op	Mild	Moderate		Severe without current surgical indication
Aortic stenosis (including bicuspid valve)	5 years	2 years		6-12 months
Aortic regurgitation	Discharge	Normal LV 2 years	Dilated LV 1 year	6 months
Mitral stenosis	5 years	2 years		12 months
Mitral regurgitation *consider TOE for? repair	Discharge – Unless abnormal valve then 5 years	Normal LV size & function - 2 years	Dilated LV* - 1 year	6 -12months*

Post valve replacement/surgical mitral valve repair

- **All should have baseline post-op echo**
- **TAVI: 3 years until evidence of valve degeneration then annually**
- **Mechanical: 3 years**
- **Bioprosthetic: 3 years until evidence of valve degeneration then annually**
- **Surgical mitral valve repair: 1 year then every 3 years**

Post elective PCI and post ACS

If EF>50%, no further revascularization or device therapy planned, no other medical issues than nurse led cardiac rehabilitation clinic only. Otherwise, medical FU, timing to be determined at discharge.

Post CABG

Routine cardiac rehab follow-up 2-4 weeks, with medical FU up 6-12 weeks post op, then discharge unless EF<50% in which case repeat echo after 3 months of max. tolerated medical treatment to inform need for device therapy.



Heart failure

- Initiation/titration of heart failure disease-modifying drugs:
 - refer to (Nurse-led) Heart Function/Heart Failure Clinic, depending on local pathway/criteria
- Resistant/fragile clinical heart failure requiring case-management (especially diuretic regimes):
 - refer to (Nurse-led) Heart Function/Heart Failure Clinic
 - consider if suitable, referral for heart transplant assessment if not improving on medical/device therapy
- Patients < 75yrs with HFrEF (EF < 40%), once Rx optimised:
 - consider yearly FU
- Stable/max. medical treatment, no device therapy planned:
 - discharge to GP and/or referring clinician
- CRT/ICD + HF patients should be followed long term - 1-2 yearly
- If uncertainty re FU plans, please discuss with lead cardiologist

Atrial fibrillation

1. Anticoagulation decision finalised/good rate control and no other cardiac reason for follow-up: Discharge
2. Post DCCV: 4-6 weeks with an ECG, clear plan for future management including eligibility for repeat DCCV, rhythm or rate control communicated to GP
3. On flecainide/sotalol/amiodarone – 1-2 year FU
4. Post ablation FU – d/w EP team

Aortopathy

Genetic Aortopathy

- If suspected or confirmed: comprehensive history and refer to CIDG
- Refer to guidelines for timing and type of serial imaging and treatment for specific conditions

Degenerative aortopathy

Aortic dimension	3.5-3.9cm	4.0-4.4cm	4.5-4.9cm	5.0-5.4cm
Follow-up	Not required (consider follow-up at 5 years)	Repeat at 1 year If no progression, 5 yearly review	Repeat at 1 year If no progression 2 yearly review	Annual imaging
Other imaging modalities	Repeat assessments should use the same imaging modality. Consider CT or MRI if reliable images cannot be obtained by echo. CT or MRI should be performed if being considered for surgical intervention.			

Other

- CRT/ICD patients should be followed long term - 1-2 yearly
- HCM aged <70 every 1-2 years, >70 consider discharge



Appendix 2: outpatient cardiology referrals—a survey of views held by general practitioners (GPs)

Methods

A convenience sample of GPs within Waitematā completed an anonymous Google survey of their views on the current cardiology referral process. Auckland Health Research Ethics Committee approved the project (AH28636). When the authors were fielding phone calls from GPs during their clinical work, they invited each caller to participate in the survey. It was anonymous by design so as to encourage participation; therefore, no information is available on the profile of practices who participated.

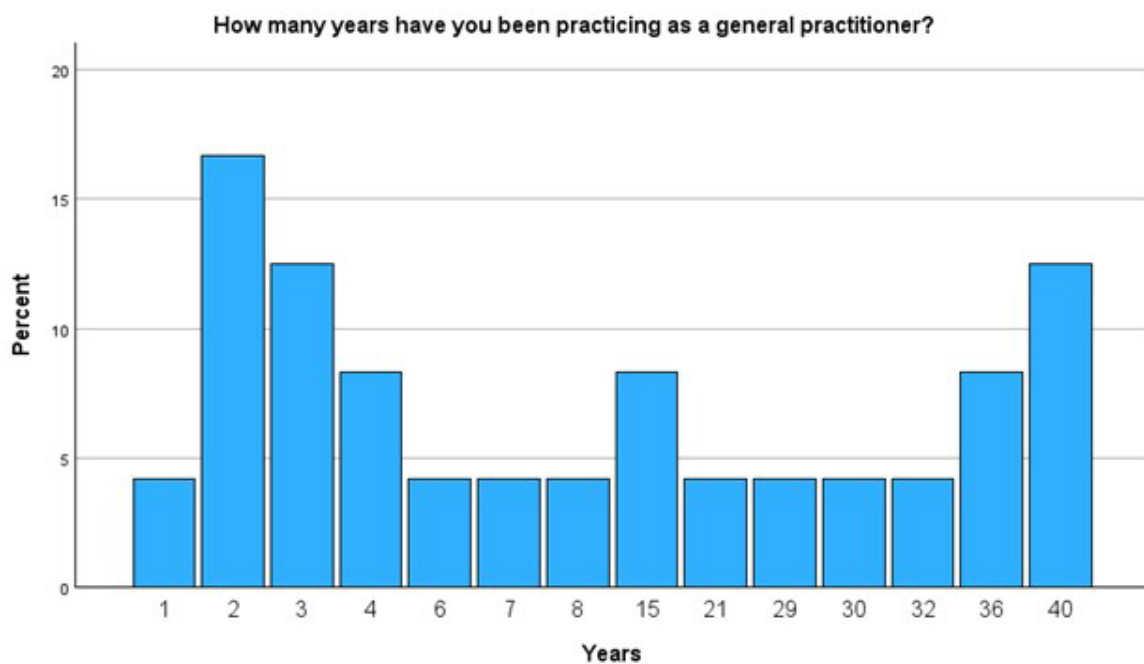
Data analysis

This is a descriptive study. Responses are reported as percentages. There was no comparator group, and numbers were too small for statistical analysis.

Results: questions and response rates

1. How many years have you been practicing as a general practitioner?

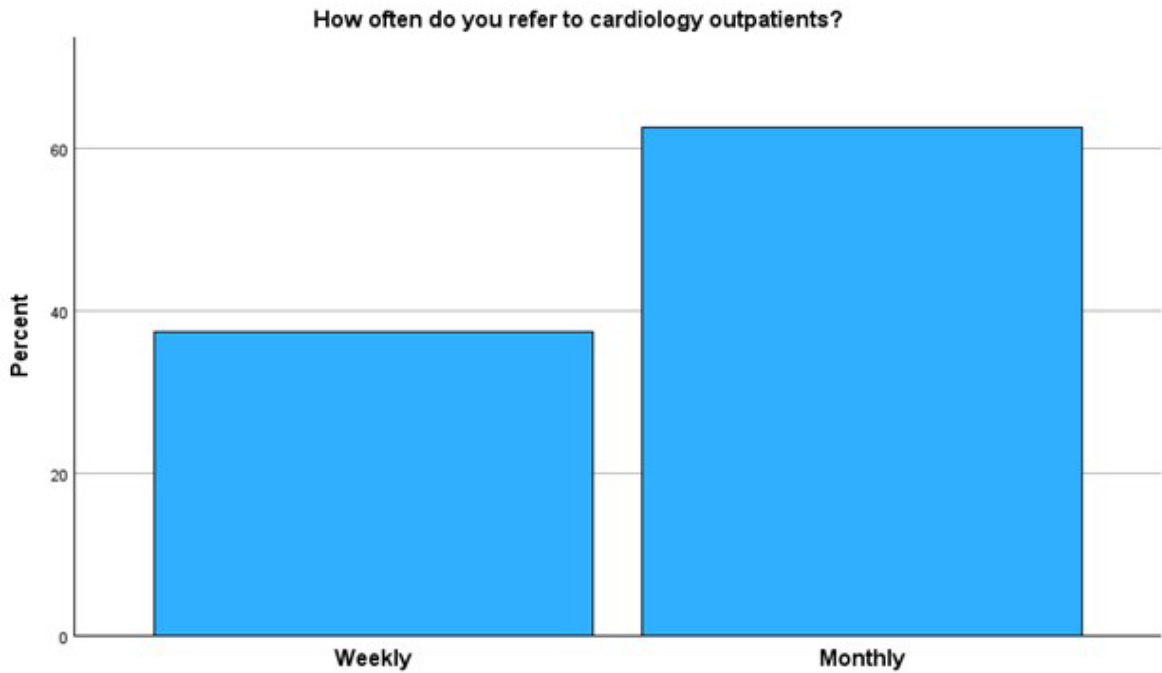
Twenty-four GPs answered the questionnaire. Years in practice ranged from 1 to 40 years, with most



2–4 years and 36–40 years. Most (61%) referred to cardiology monthly, and 39% referred weekly.

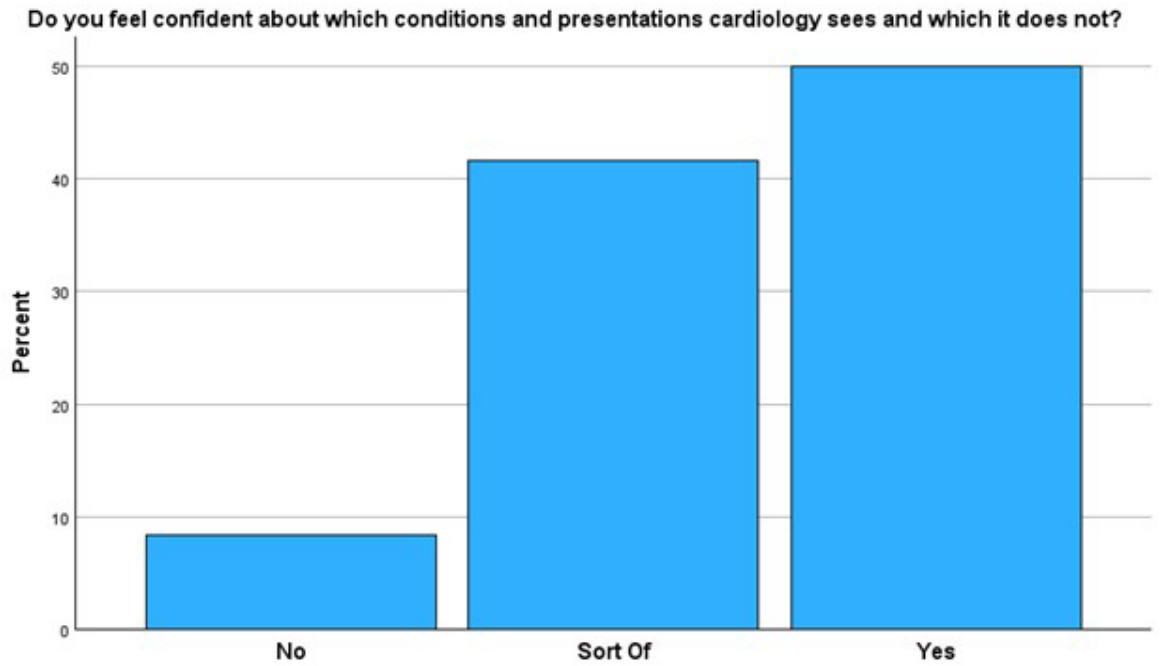
2. How often do you refer to cardiology outpatients?

- Daily
- Weekly
- Monthly



3. Do you feel confident about which conditions and presentations cardiology sees and which it does not?

- Yes
- No
- Sort of

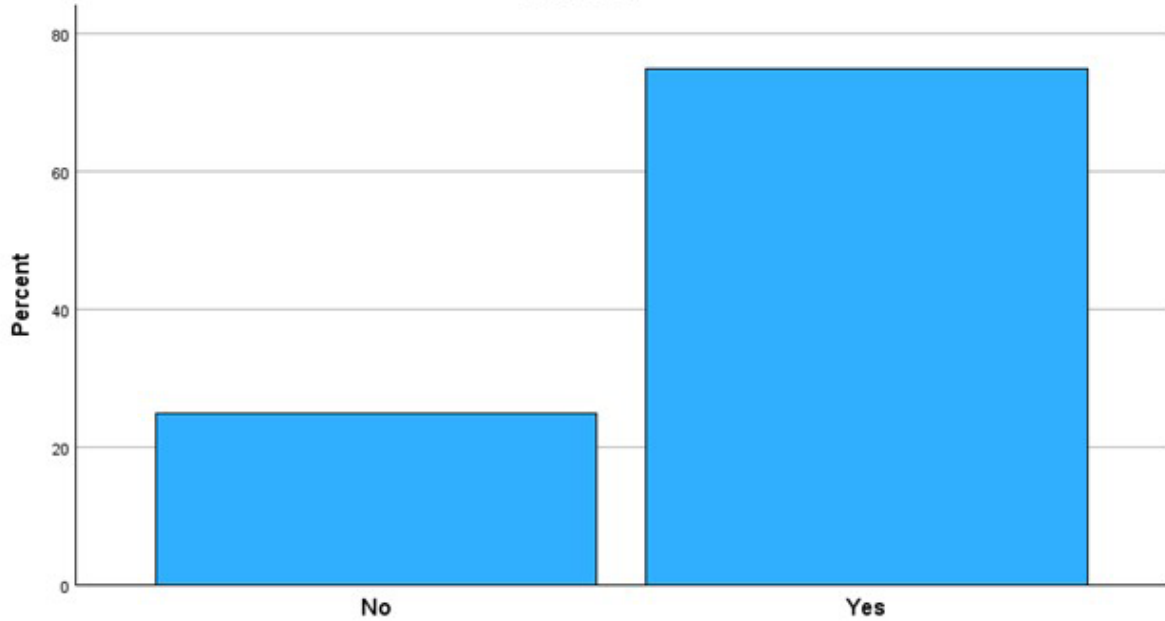


Only half are confident about which conditions and presentations were seen by cardiology.

4. Would it be helpful to have on the front page of the referral portal a list of the conditions we see and those we don't see?

- Yes
- No

Would it be helpful to have on the front page of the referral portal a list of the conditions we see and those we don't see?

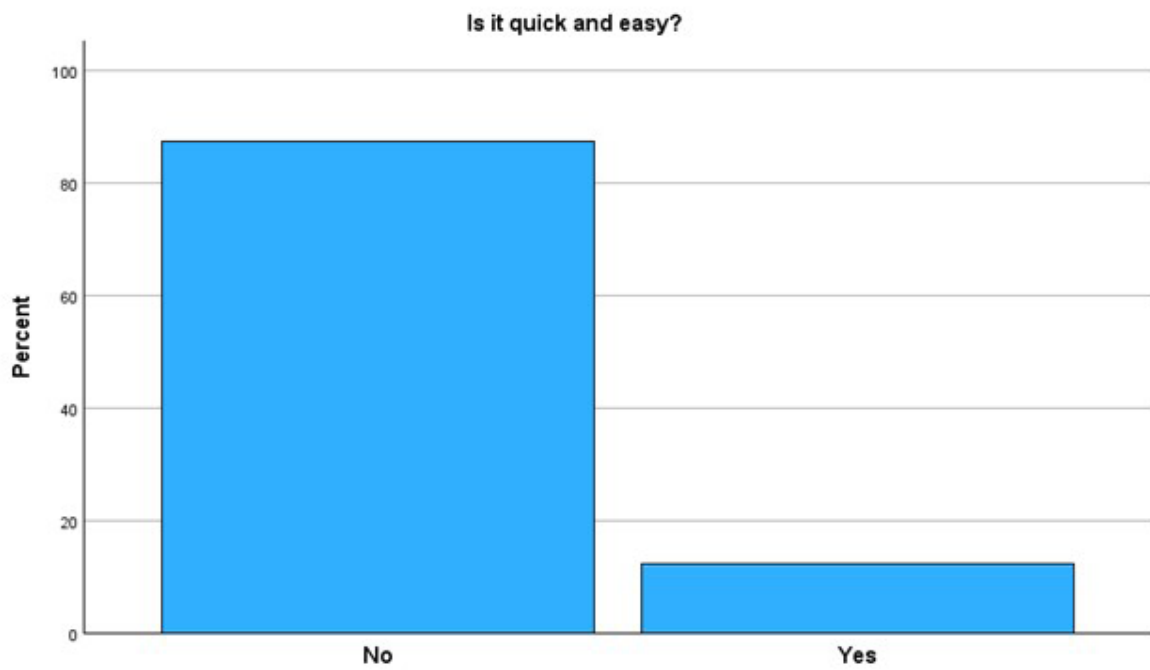
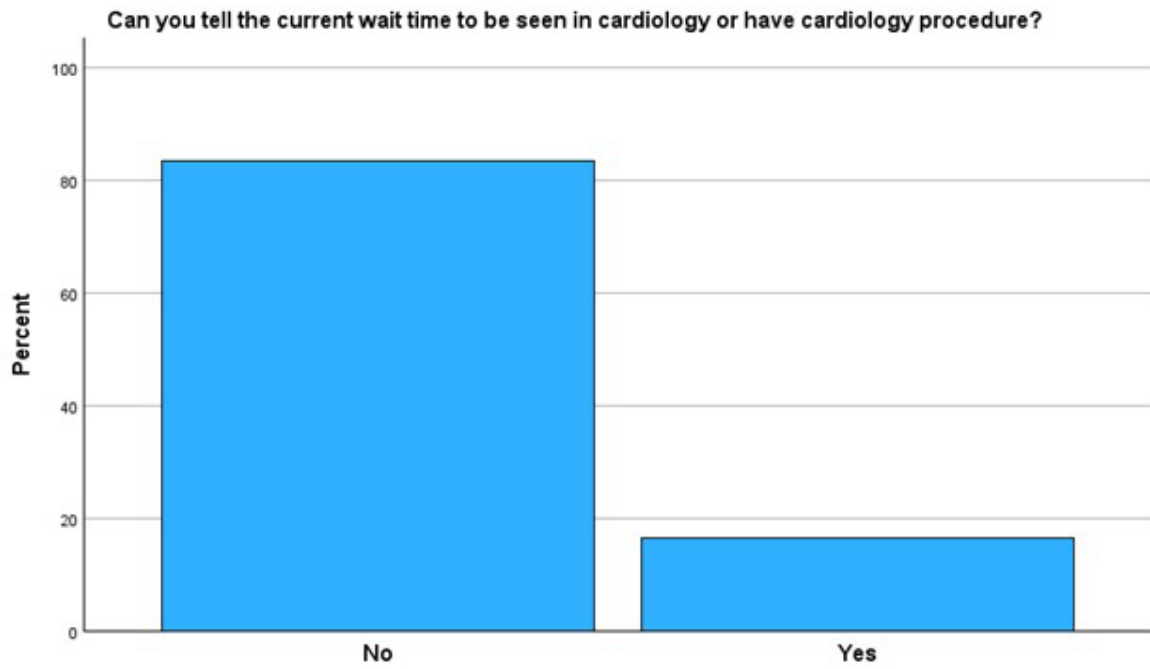


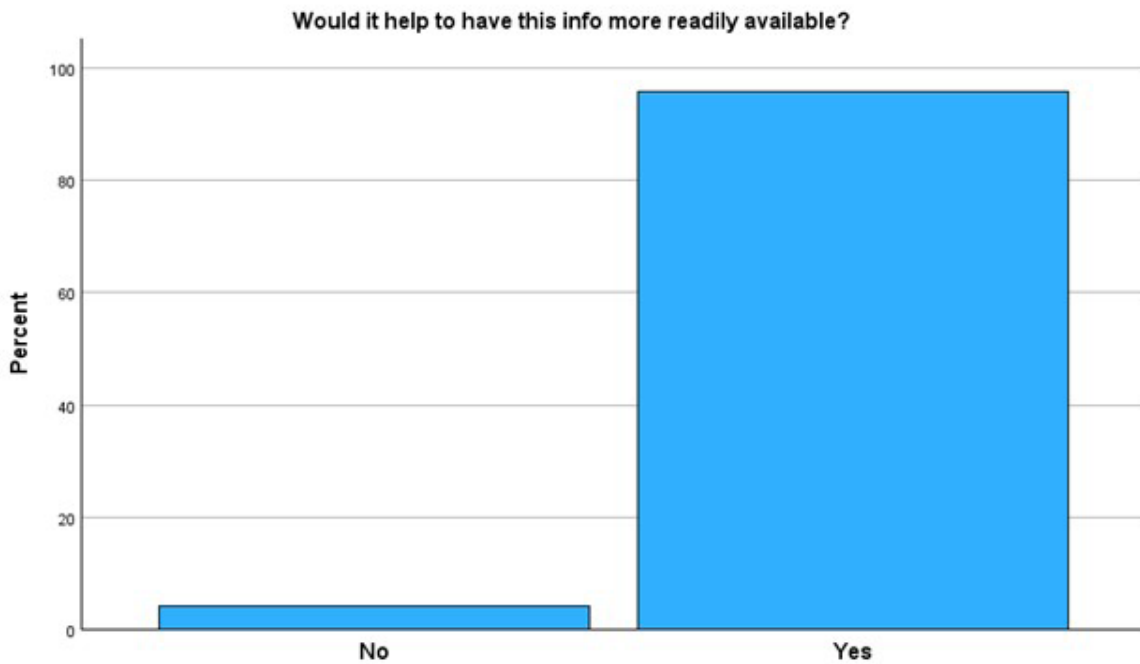
The majority (75%) would like a list on the referral portal of which conditions cardiology accepts and suggestions/links where to refer other conditions.

5. Can you tell the current wait time to be seen in cardiology or have a cardiology procedure? Yes/no

Is it quick and easy? Yes/no

Would it help to have this info more readily available? Yes/no



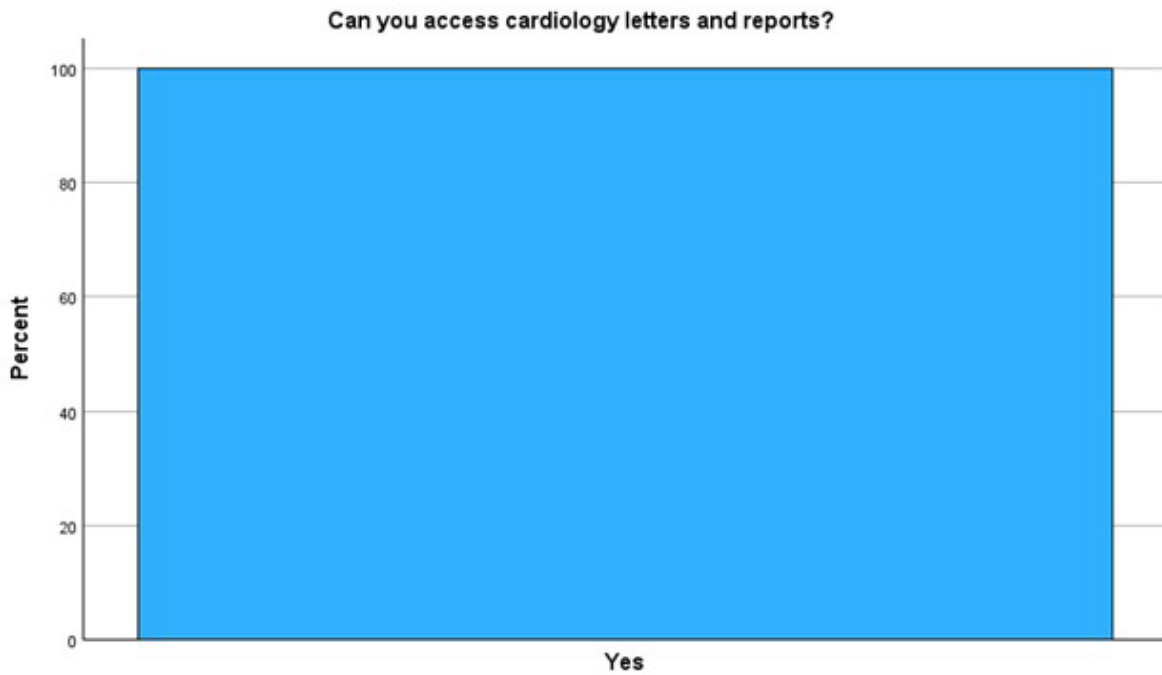


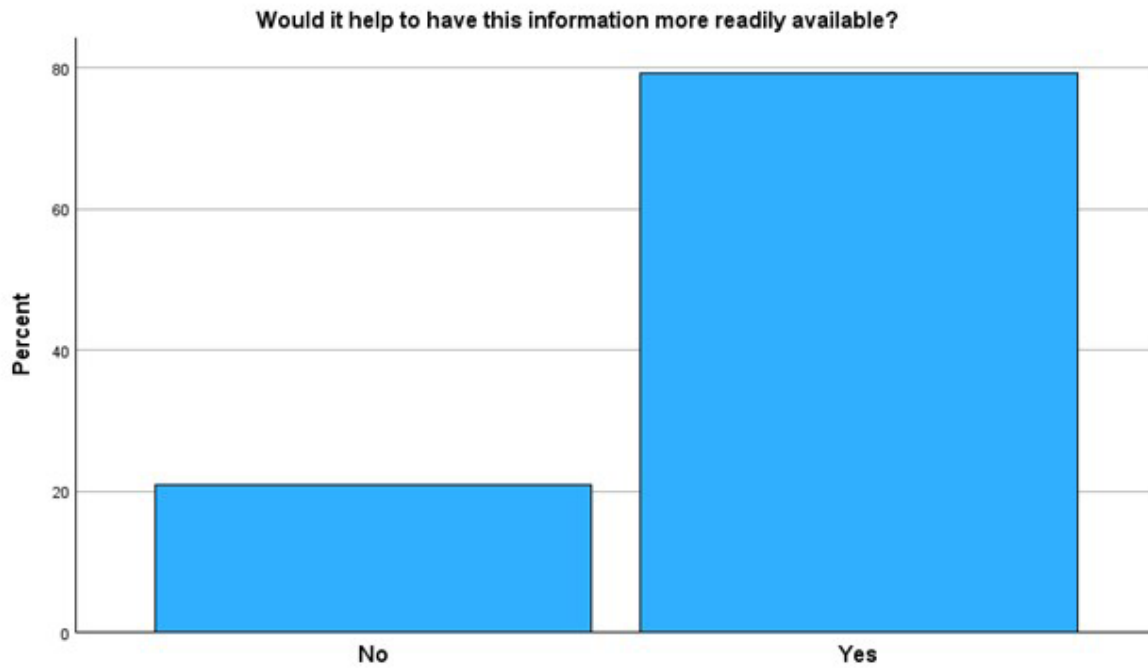
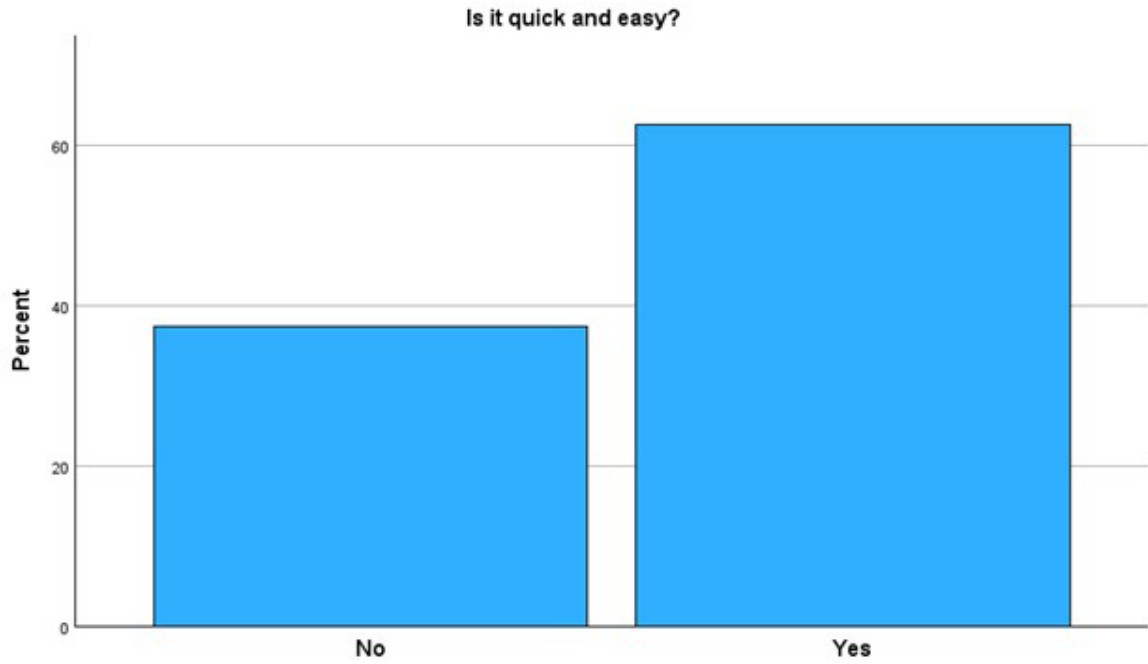
Most (83%) GPs cannot access the current wait times for clinic, with 96% wanting this information to be more readily available.

6. Can you access cardiology letters and reports? Yes/no

Is it quick and easy? Yes/no

Would it help to have this info more readily available? Yes/no

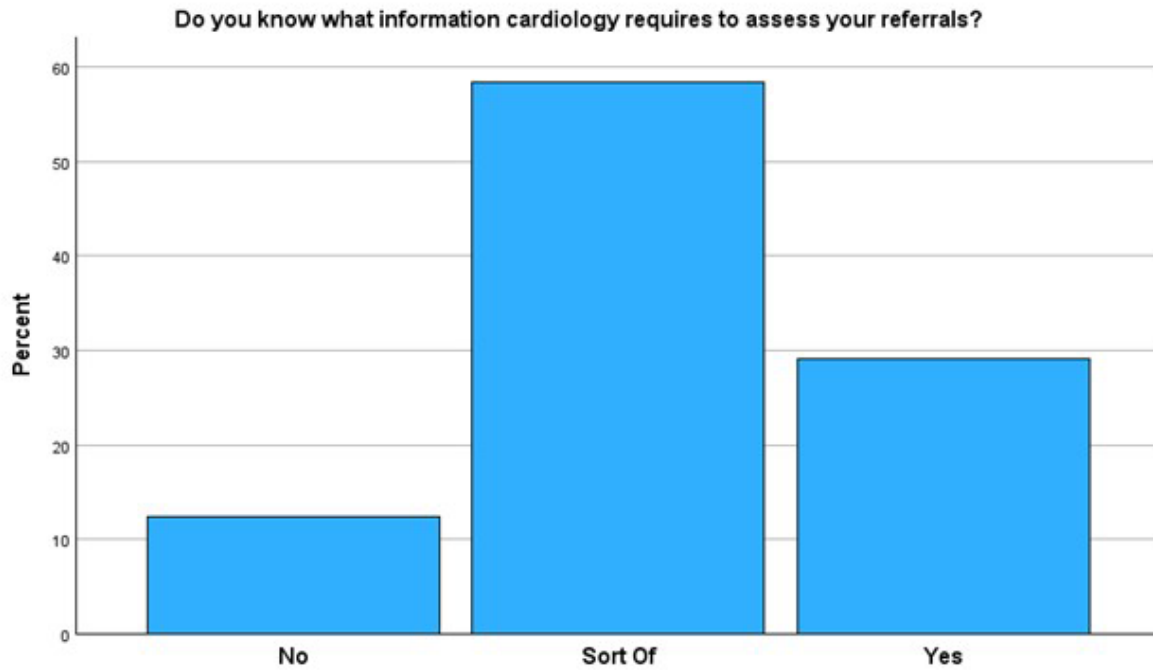




All respondents could access cardiology reports and letters, and it was quick and easy for 61%. Yet 79% felt it could be more accessible.

7. Do you know what information cardiology requires to assess your referrals?

- Yes
- No
- Sort of



Only 29% felt confident about the information required for cardiology to triage a referral.

8. What resources do you use to assist with management of cardiology patients?

Please tick the resources that you have heard of:

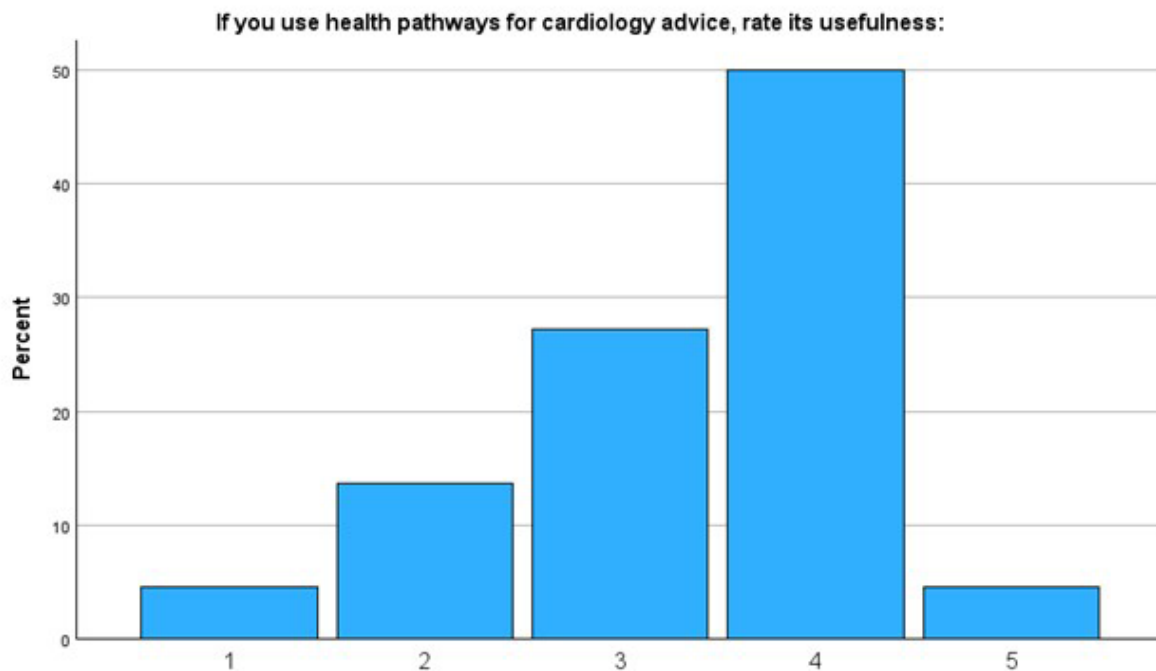
- Regional cardiology guidelines
- NZTA guidelines
- Health pathways
- Other:

9. Please tick the resources that you use:

- Regional cardiology guidelines
- NZTA guidelines
- Health pathways
- Other:

10. If you use health pathways for cardiology advice—rate its usefulness:

[Not at all useful] 1, 2, 3, 4, 5 [Extremely useful]



11. How can health pathways be improved?

Prominent on GP respondents' wish lists were shorter wait times and better availability of investigations (45%), quicker specialist advice (21%) and more comprehensive referral guidelines (health pathways) (29%).

12. Do you prefer obtaining the information you need via online resources or sending referrals to cardiology?

When it comes to preferred resources for cardiology issues, GPs were divided. Some relied on referrals to cardiology (33%), others used online resources (25%), and a significant portion used both (38%). Health pathways emerged as the most popular online resource, with 92% of respondents using it. However, not all found it helpful, as indicated by the responses to questions 10 and 11 above.

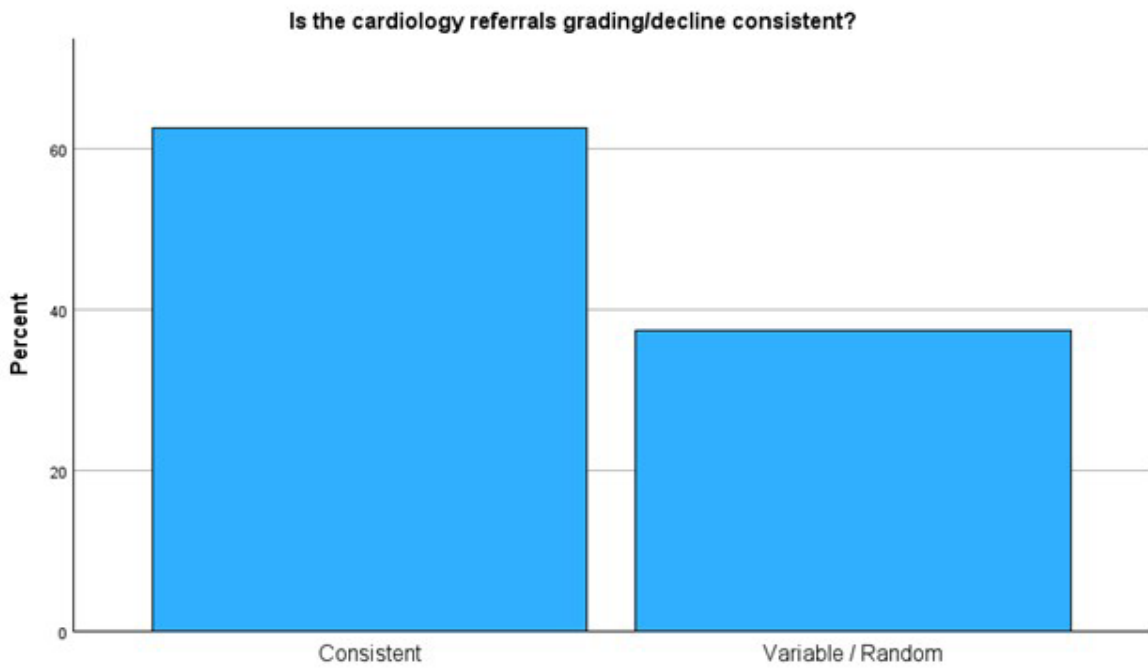
13. How could the cardiology referrals process be made easier?

14. What else would make it easier for GPs to access the information they need to manage cardiovascular conditions?

GPs' suggestions for improvement included flow charts, more explicit referral guidelines, surveillance information and information on cardiac medication. Notably, many GPs preferred succinct information, highlighting the need for simplicity and clarity in the referral process.

15. Is the cardiology referrals grading/decline consistent, or does it seem variable/random? (Circle)

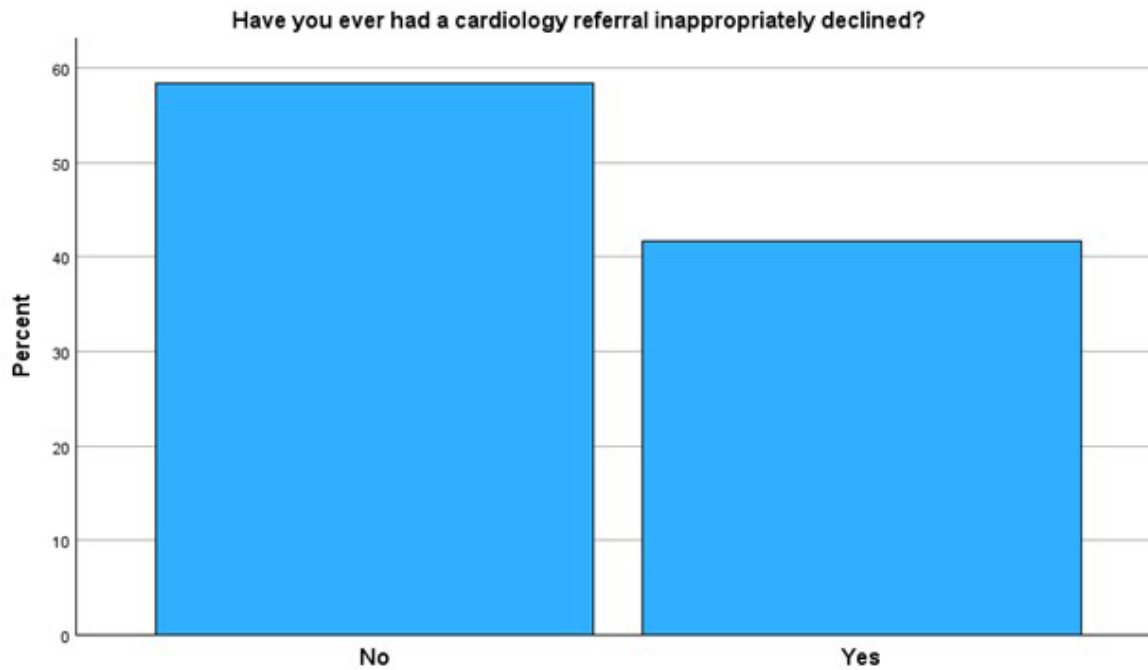
- Consistent
- Variable/random

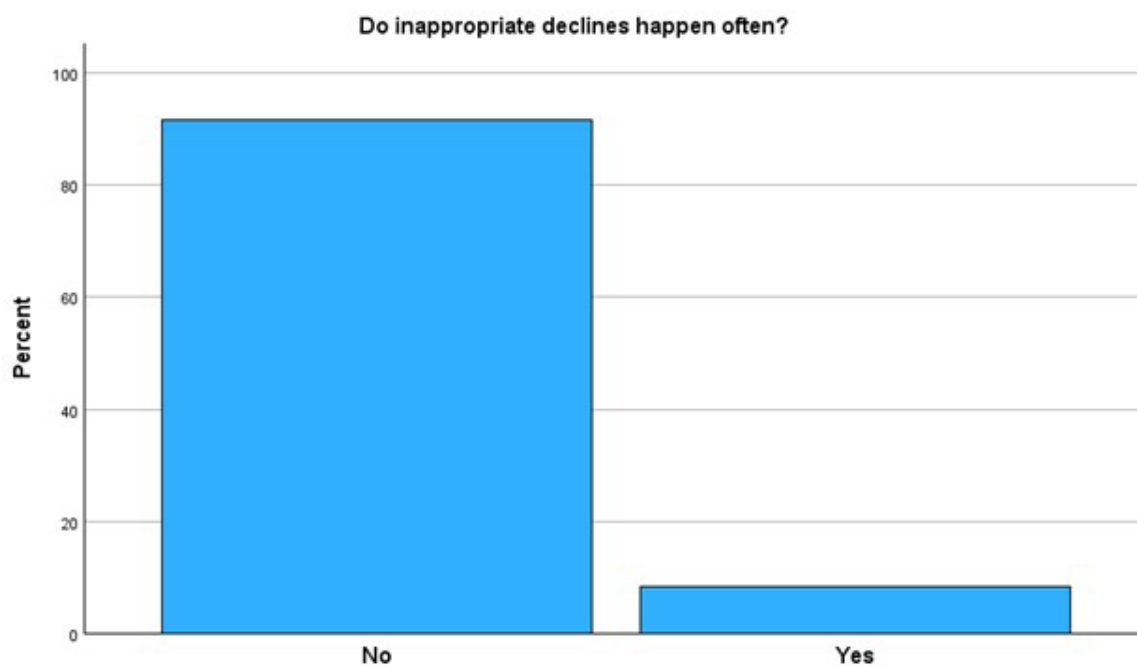


Inconsistent referral grading had been experienced by 38% of respondents.

16. Have you ever had a cardiology referral inappropriately declined? And does this happen often?

Inappropriately declined? Yes/no
Does this happen often? Yes/no





Less than half (42%) had a referral declined inappropriately, but this was infrequent (8%).

Discussion

It is a struggle for triaging cardiologists to keep up with the volume of referrals. The cardiologist shouldn't deal with those that can be handled clerically, and it would help to provide the GP with direct access to relevant information. A GP comment highlighted a perverse incentive in the current system. Sending a referral requesting a cardiologist to provide the result of a Holter monitor test (four mouse clicks) is easier than finding the report online (eight mouse clicks, including a log-in page). Streamlining the system to make it easier for GPs to find information themselves will benefit all parties. We understand that more information is being made accessible to GPs but note that GPs cannot always find available information. One reason is the so-called "friction" in the navigation process. Other reasons need to be explored.

An option to improve accessibility to GPs is to compile relevant links on a single dashboard page, like the Snapshot used for Health New Zealand – Te Whatu Ora Waitematā inpatients (Appendix 2 Figure 1).

Appendix 2 Figure 1: Example of the current Snapshot page for Waitematā inpatients.

The screenshot displays a patient snapshot for Testsp, Prodsmoketest, born 20/11/2000 (24 Years), Female, in Ward / Room: [redacted]. The page is divided into several sections:

- COVID-19 Tracing:** Click to record contact with this patient today. Record Contact.
- COVID-19 Vaccination:** Not vaccinated.
- COVID-19 Stream:** Not admitted.
- Testsp, Prodsmoketest:** RESUS STATUS MAY BE OUT OF DATE. Click here to view details. Includes personal details like location, address, GP, and ethnicity.
- Presenting Complaint:** Unable to display Admission Document. Try viewing it in the EDS tab of Clinical Portal or look in the notes.
- Current Clinical Pathway(s):** Patient is not admitted. View History.
- PMH from previous EDS:** Cardiology Template, Cardiology Template. Includes dates 16/09/2024 and 27/11/2023. Frequently Used Links and Submit Feedback.
- Documents / Procedures:** List of medical events from 23/10/25 to 16/09/25, including Latest ECG, Community Summary (SWE), Adult Referral Note, Allied Health Assistant Programme, Clinic Letter, Global Rating of Change (GRoC), Scar and Lymphoedema Follow-up, Scar Management Initial Assessment, Scar and Lymphoedema Follow-up, Adult Referral Note, PAEDIATRIC MEDICAL SERVICES NDHB Paediatric Summary, Allied Health Assistant Programme, HAEMATOLOGY Chemotherapy Treatment Summary, Anaesthetic Record, and Anaesthetic Record.
- Radiology:** IR Haemoglobin, CT Chest & Abdomen & Pelvis C+, Chest PA & Lateral. Observe Radiology.
- Observations:** No observations recorded or patient is not admitted. View Observations.
- Add Entry to Notes:** This patient doesn't appear to be admitted. Open notes and try to add these directly.
- Allergies (3):** ACE Inhibitors Cough, Aspirin Rash, Cephalosporins Rash.
- Referrals:** Specialist, Outpatient, GP. List of referrals from 02/07/2025 to 11/04/2024, including Teleradiology Request, Hoher Monitor, and Smoking Cessation. Add Referral options for Specialist, Outpatient, Referral Inbox, and All Health.
- Links:** Book Bed, Ecar, EDS, vYata, Info, Mailer, Marston, MH Snap, Notes, Pk2View, Portal, Quantum, Visit View.
- Inpatient Medications (MedChart):** Community Dispensing (Testsp), Electronic Medicine Reconciliation. No medications are prescribed in MedChart for the current visit.
- Selected Biochemistry & Haematology Results:** Add Tests, Pending Orders.
- Selected Microbiology Results:** This is not a complete list of all microbiology results - please check Ecar for all tests.

Date	Time	Test Name	View
20/10/2025	12:28	Peripheral Blood Culture	View
17/10/2025	12:59	Aspirated Pus	View
09/10/2025	12:20	Peripheral Blood Culture	View
03/10/2025	16:02	Peripheral Blood Culture	View

The aim is to reduce the number of declined referrals by providing GP referrers with more information and easier access to that information.

It is suggested that the dashboard have single-click links to the following:

- List of conditions seen by cardiology.
- List of conditions frequently referred to cardiology incorrectly, with links to the correct recipient.
- Current list of approximate wait times for clinic and investigations.
- Regional guidelines on follow-up intervals for surveillance of valvular lesions and dilated aortas (have now been posted).
- Patient-specific information:
 - Pending referrals and appointments.
 - Recent encounters (inpatient/outpatient).
 - Results of recent cardiac investigations.

Limitation

Only 24 GPs were surveyed. Greater numbers would give more confidence in the findings.

Conclusion

The GPs canvassed had positive views on aspects of the referral process but wanted more guidance on who and when to refer. They desired information on waiting times and better access to patient information held by the hospital. Options for improvement are discussed.

Appendix 3: audit of declined outpatient cardiology referrals

Introduction

Some declined referrals may be wasteful when they invoke fruitless time and effort by the referring general practitioner (GP) and triaging cardiologist. This can be a type of inefficiency (or “churn”). We catalogue reasons for referral rejection. Auckland Health Research Ethics Committee approved the project (AH28636).

Methods

Administrative coding proved inaccurate (which suggests caution about deploying artificial intelligence [AI] on such a data source). Between 3 January 2022 and 28 November 2023 (22 months), there were 3,505 referrals with a clerical categorisation of “declined”. Reviewing individual patients’ records, the total fell to 3,145, and these were manually categorised according to the reasons for referral and rejection.

Results

Clinical reason for referral

Palpitations comprised the largest volume of declined referrals (25%), followed by chest pain (10%) and valvular (10%) (Table 1).

Appendix 3 Table 1: Declined GP referrals; reason for referral.

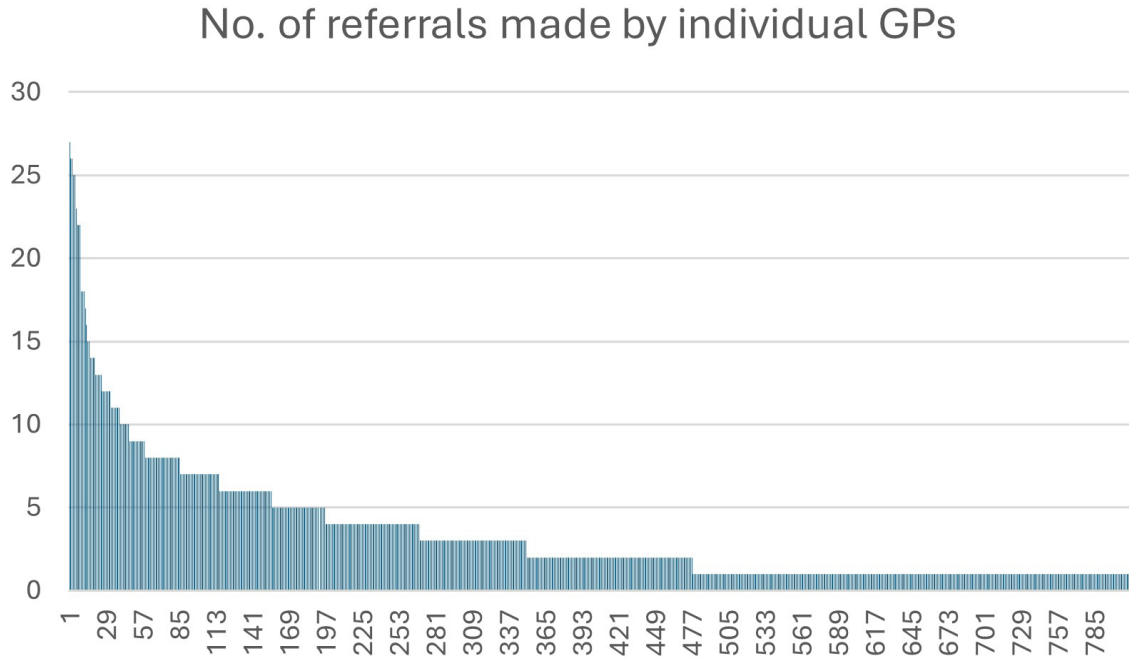
Disease category	Frequency	Percent
Palpitations/brady/ECG	786	25
Other	646	21
Chest pain	321	10
Murmur/valvular	315	10
AF/flutter/SVT	244	8
Heart failure	241	8
Risk factor management	153	5
Hypertension	152	5
Breathlessness	139	4
Syncope/presyncope	96	3
Dilated aorta	28	0.9
Cardiomegaly	17	0.5
Not a GP referral	7	0.2

GP = general practitioner; ECG = electrocardiogram; AF = atrial fibrillation; SVT = supraventricular tachycardia.

During the time period, there was a total of 28,496 GP referrals. Only 49% were categorised, and we did not manually confirm the category of those that were. Roughly, the clerical reasons for referral were: chest pain 58%, palpitations 19%, breathlessness 8%, murmur 7% and heart failure 5%.

GP referral rates

Figure 1.



The number of rejected referrals made by individual GPs varied from 27 to one (Figure 1). The median was two, and the mode was one. Little can be inferred from these data without knowing how many patients each GP sees.

Reason for referral rejection

Appendix 3 Table 2: Declined GP referrals; reason for being declined.

Reason for decline	Frequency	Percent	Avoidable
Bespoke advice or interpretation	765	24	
Admin transfer to another service	555	18	Possibly
Relevant booking pending, no change to priority	394	13	Possibly
Generic advice given	297	9	Possibly
More information requested	248	8	Possibly

Appendix 3 Table 2 (continued): Declined GP referrals; reason for being declined.

Seen/admitted since referred	179	6	Possibly
Relevant results communicated	170	5	Possibly
Other	126	4	
Communication for filing	115	4	
Referral declined but procedure ordered	105	3	
Duplicate referral	60	2	Possibly
Referral not declined	33	1	
Advised to refer elsewhere, bespoke	32	1	
Follow-up advice as per regional valve, aorta guideline	33	1	Possibly
Relevant booking pending, priority increase requested	23	0.7	
Patient uncontactable	10	0.3	

The reasons for the referral being declined are in Table 2. The “more info requested” category is usually a request for an ECG. The commonest “bespoke advice” is for the duration of dual antiplatelet therapy, followed by lipid management, other medication, surveillance of aortic dilation, and anticoagulation.

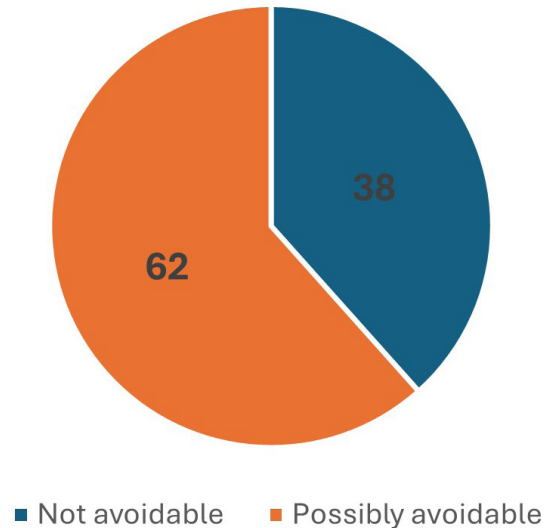
“Admin transfer to another service” is the biggest category of possibly avoidable referrals. Many of these are palpitations transferred to general medicine, and hypertension transferred to the renal service. Such transfers don’t relieve the overall demand for hospital services.

Avoidable referrals

We defined “possibly avoidable” referrals as those that would not need to be dealt with by a cardiologist if simple measures were instituted, such as: providing GPs with access to more information such as where to refer certain conditions, thresholds for referral of specific conditions, easily accessible results of investigations and the current appointment status of patient. We deemed 1,936 (62%) of declined referrals potentially avoidable (Figure 2). These included: “sent to wrong service” (24%), “already has appointment” (13%), “does not require review” (10%), “inadequate information” (8%), “seen since referred” (6%), “relevant results sent” (5%) and “duplicate referral” (2%). These are a drag on the efficiency of the triage process, increasing workload for clerical and clinical staff, with an ultimate adverse impact on patient care.

Figure 2.

Percentage of declined referrals that could possibly have been avoided



Patient outcomes after a declined referral

Twenty-four patients (0.8%) died within 90 days of a declined referral. Four patients died at -7, 1, 1 and 2 days after referral, suggesting that rejection of the outpatient referral could not have influenced the outcome. Review of the referrals for patients who subsequently died was not informative. The numbers are small and the information contained in the referrals was variable and often succinct, although not different from the referrals for patients who did not die. It is anticipated that changing from free-text referrals to the collection of structured information appropriate to the particular clinical indication will allow informative audit of adverse events. The learnings can then be used to iteratively refine the choice of variables collected and the decision thresholds for rejection.

Hospital admissions as adverse event were not assessed but should be part of the ongoing audit that iteratively improves future collection of structured data.

We did not manually assess re-referrals. The following data from the administrative coding provide ballpark estimates:

- 60% (1,245) of declined referrals do not get re-referred
- 2/3 (826) subsequent re-referrals are accepted

As an observation, if the accepted referrals had adequate information to be accepted the first time, that would be 413 fewer referrals to process on this basis alone. Even declining a referral requires opening several windows in the electronic medical record. Each has a lag time, which is worse during working hours. Therefore, getting the correct information upfront saves a worthwhile amount of time.

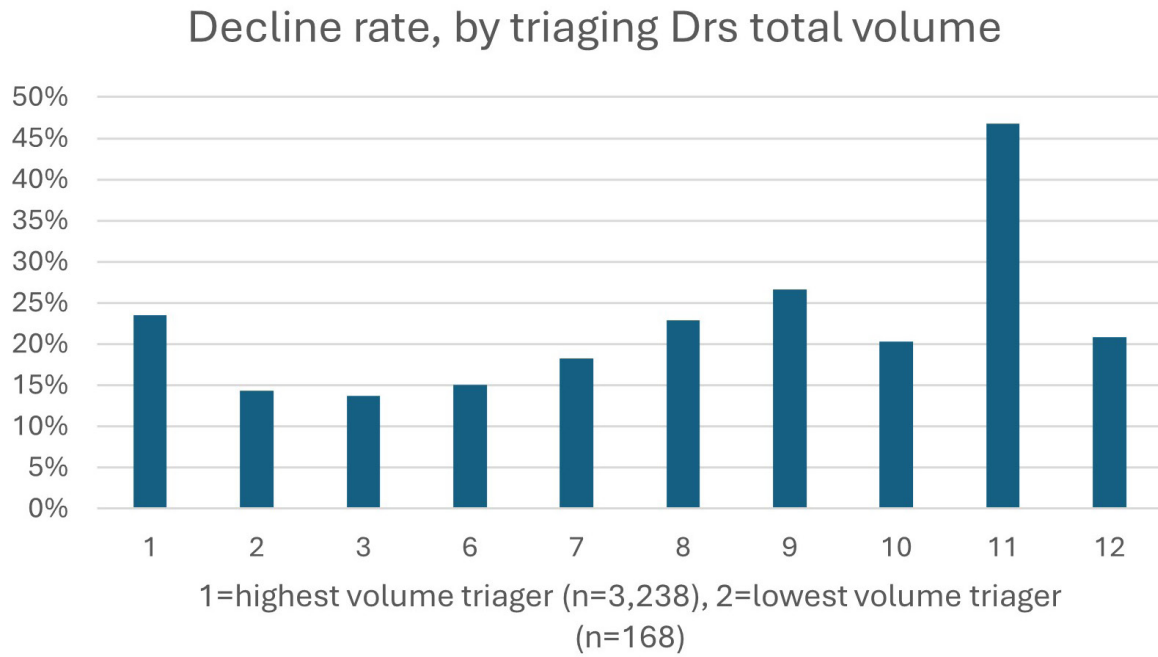
Cardiologist variability in rejection rate

Cardiologist decline rates varied widely from 14% to 47%. Variability is an adverse indicator of health-care quality. Its reduction is the specific goal of recent national initiatives.¹⁻⁵

Six doctors with more than 10 years of clinical cardiologist experience had a decline rate of 26%, and four cardiologists with less than 10 years of experience had a rate of 17% (Figure 4). These numbers are too small for statistical analysis.

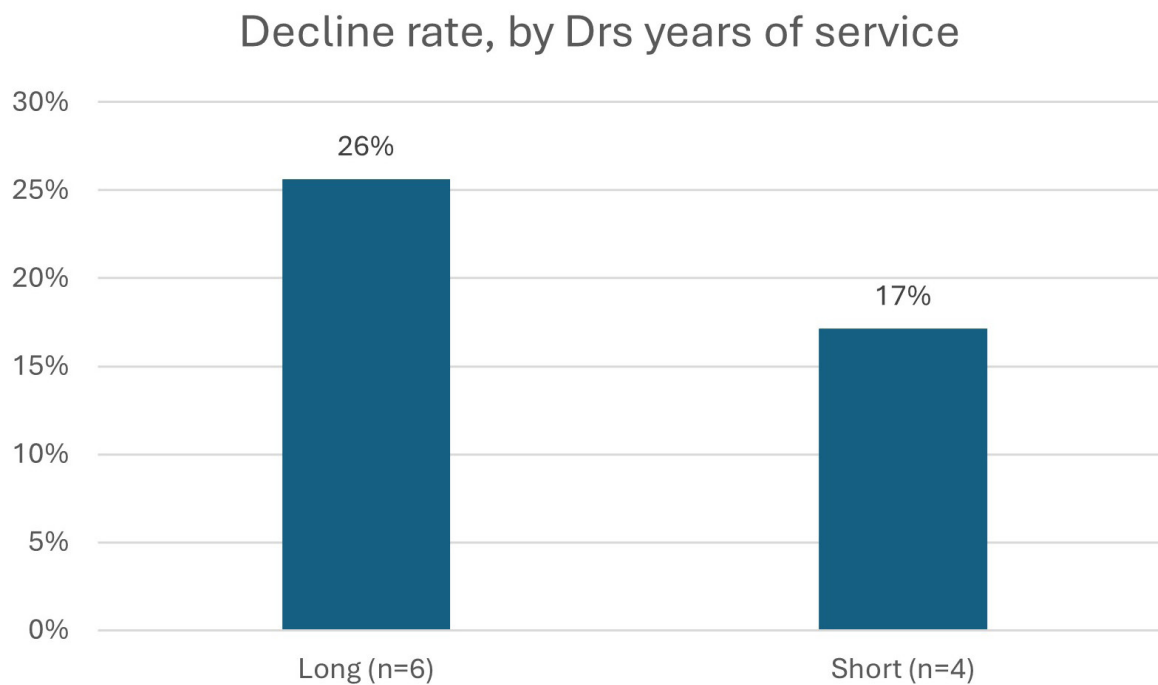
The decline rate was unrelated to the cardiologists' triaging volume (Figure 3).

Figure 3.



The decline rate is not related to the triaging cardiologists' overall volume.

Figure 4.



Under-resourcing causes more work via positive feedback

Anecdotal experience has always been that when patient delays increase, there is a concomitant increase in referrals solely due to the delays. The category “relevant booking already pending” comprises a fifth of potentially avoidable referrals and is due to delays in patient investigations. In addition, the category “other” contains a proportion of procedures that have yet to be reported. Similarly, the frequency of “request increased priority” is likely related to waiting times. These are examples of how busyness begets busyness, potentially leading to a spiral of increasing delays and inefficiencies.

Limitations

Some people with functional or non-cardiac symptoms (palpitations, chest pain) may benefit from a normal cardiology work-up and subsequent cardiologist reassurance. We acknowledge this, but the current body of work is driven by an inability to service demand with available resources. Accordingly, the consensus was to design systems that sift out organic heart disease. Being swamped with other patients will delay us seeing patients for whom we may reduce the risk of serious events.

Discussion

This study focussed on declined referrals for two reasons. From a behavioural aspect, removing unnecessary referrals gives the triaging cardiologist more time to devote to necessary referrals. More importantly, the analysis of declined referrals provides a window into the shortfalls and inefficiencies in the overall referral process.

The job of the triaging cardiologist could be facilitated by a “cardiologist triager’s dashboard”, similar to the Snapshot used for Health New Zealand – Te Whatu Ora Waitematā inpatients. It is a single page containing relevant single-click links to facilitate and speed up the cardiologist’s task of triaging referrals.

Such a page should contain single-click links to:

- Pending referrals and appointments.
- Recent encounters (inpatient/outpatient) with emphasis on those that have occurred since the date of referral—it is not uncommon for the patient to have been admitted since the referral was made. At present, this information is not quickly available to the triager, resulting in time wasted.
- Results of recent investigations, including laboratory, radiology and cardiology.

Conclusion

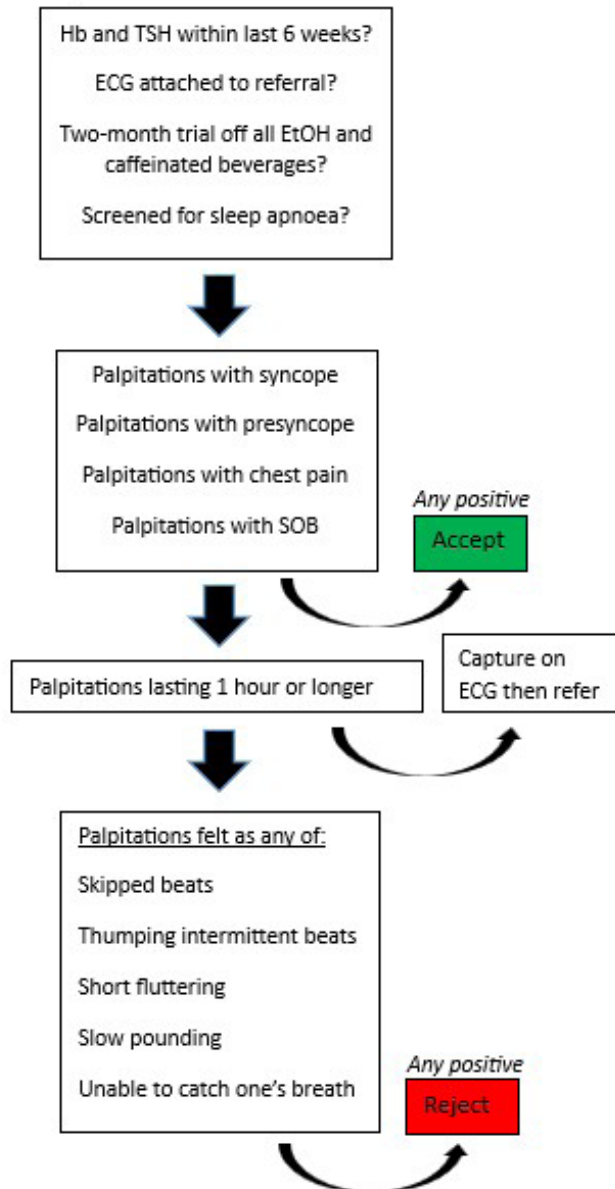
Most declined referrals were possibly avoidable altogether, mainly by providing GPs with ready access to information. There is no signal of harm from a declined referral, and most declined referrals are not re-referred. The decline rates vary between triaging cardiologists, suggesting practice standardisation is needed. Suggestions are made to improve the process.

REFERENCES

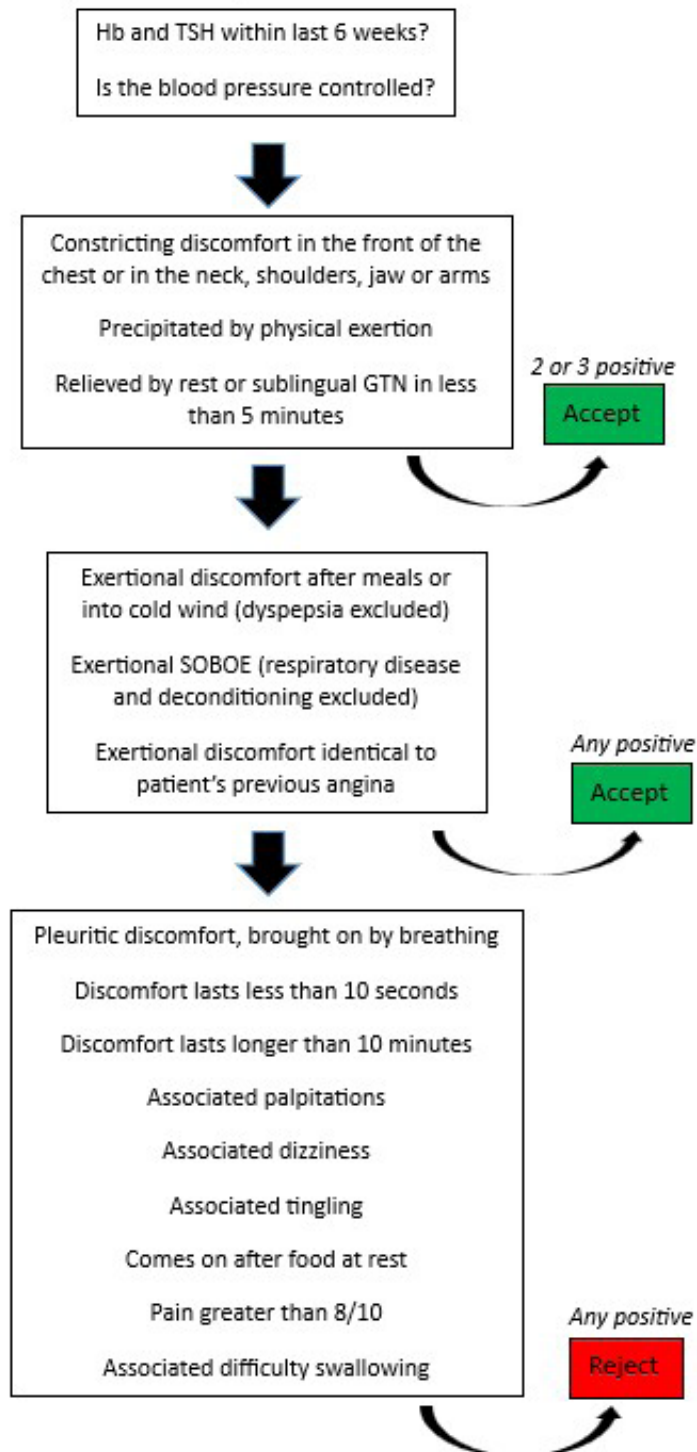
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Appendix 4: draft decision trees for illustrative purposes

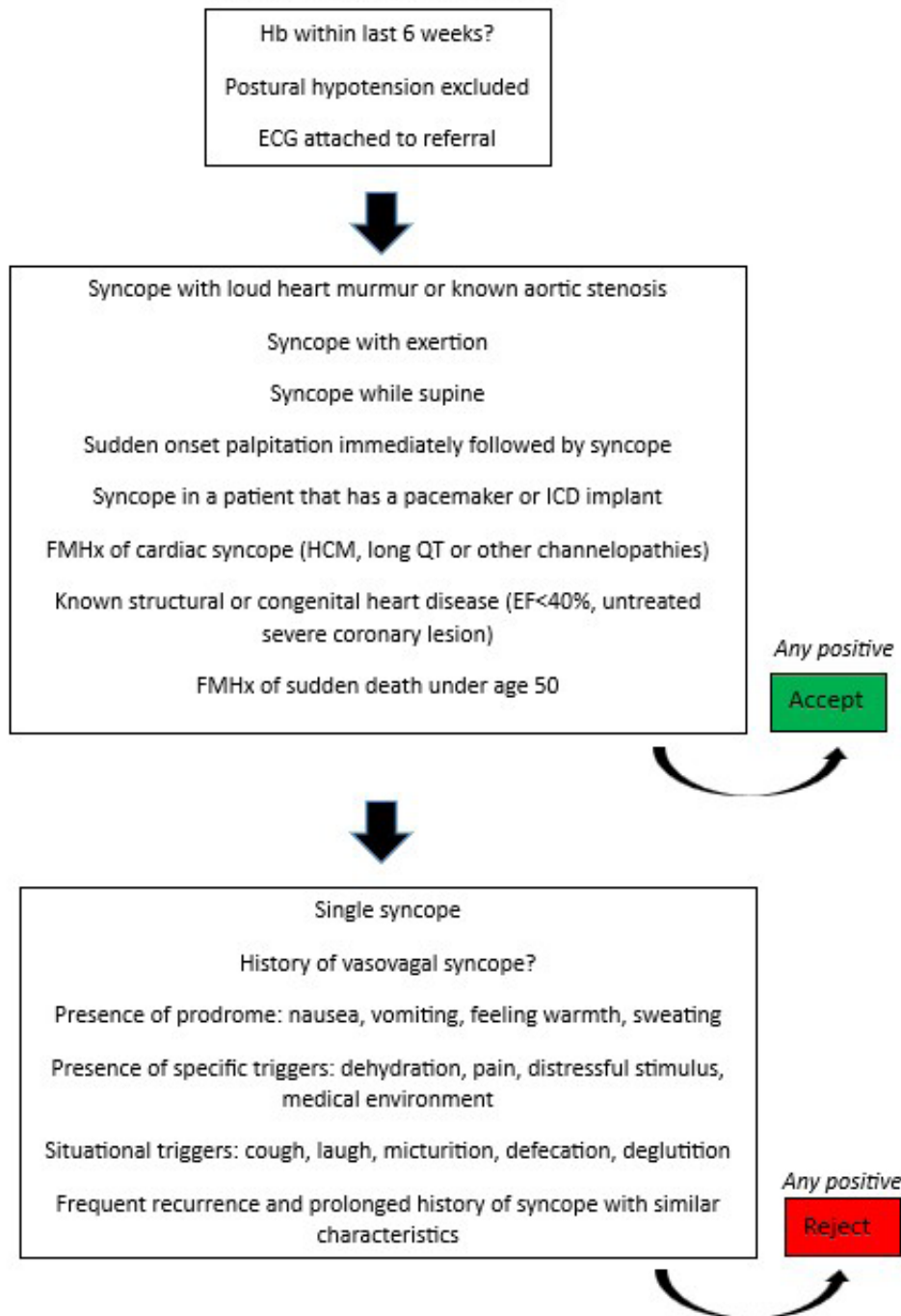
Palpitations Decision Tree



Suspected Angina Decision Tree



Syncope Decision Tree



Suspected Heart Failure

